U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Chamaesyce deltoidea* (Engelm. ex Chapm.) Small ssp. *serpyllum* (Small) D.G. Burch

COMMON NAME: Wedge spurge or wedge sandmat

LEAD REGION: 4

INFORMATION CURRENT AS OF: October 2005

STATUS/ACTION:

___ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

___ New candidate

_X Continuing candidate

___ Non-petitioned

_X_ Petitioned - Date petition received: May 11, 2004

_ 90-day positive - FR date:

_ 12-month warranted but precluded - FR date:

_ Did the petition request a reclassification of a listed species?

FOR PETITIONED CANDIDATE SPECIES:

a. Is listing warranted (if yes, see summary of threats below)? yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions (including candidate species with lower LPNs). During the past 12 months, almost our entire national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, meeting statutory deadlines for petition findings or listing determinations, emergency listing evaluations and determinations, and essential litigation-related, administrative, and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of "Progress on Revising the Lists," in the current CNOR which can be viewed on our Internet website (http://endangered.fws.gov/).

___ Listing priority change
Former LP: ___
New LP: ___

Date when the species first became a Candidate (as currently defined): October 25, 1999

___ Candidate removal: Former LP: ___

___ A - Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status.

___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

___ F - Range is no longer a U.S. territory.

___ I - Insufficient information exists on biological vulnerability and threats to support listing.

___ M - Taxon mistakenly included in past notice of review.

___ N - Taxon may not meet the Act's definition of "species."

___ X - Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Euphorbiaceae, Spurge Family

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Florida, U.S.A.

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Florida, Monroe County, U.S.A.

LAND OWNERSHIP: There is no quantitative data on land ownership. If the pattern is commensurate with that estimated for the Big Pine partridge pea (Ross and Ruiz 1996), then roughly 90 percent of the plants are on National Key Deer Refuge and the remainder occur on the 20-acre (8 hectare) Terrestris Preserve owned by The Nature Conservancy and unprotected, privately-owned lands within the vicinity of the Refuge.

LEAD REGION CONTACT: Richard Gooch, 404-679-7124 richard_gooch@fws.gov

LEAD FIELD OFFICE CONTACT: South Florida Ecological Services Office, Phillip Hughes, 305-872-2753 phillip_hughes@fws.gov

BIOLOGICAL INFORMATION:

Species Description: Wedge sandmat is a small prostrate perennial herb. The stems are slender and numerous, radiating out from the tap root. The leaves are more or less triangular. The "flowers" are cyathia, the specialized inflorescences characteristic of the genus *Euphorbia* and its close relatives. Reproduction is sexual. No studies of reproductive biology or ecology have been conducted, and these topics are poorly known for *Chamaesyce* in general.

Taxonomy: Small collected plants on Big Pine Key and first described *C. deltoidea* ssp. *serpyllum* as *C. serpyllum*. The taxon was later found to be related to the *C. deltoidea* complex, and subsequently ascribed to it. That complex includes several additional taxa found in the pine rockland flora of Miami-Dade County (Bradley and Gann 1999). *Chamaesyce* is distinguished by having the main stem abortive just above the cotyledons. Synonyms: *Chamaesyce serpyllum* Small, and *Euphorbia deltoidea* Engelm. ex Chapman var. *serpyllum* (Small) Oudejans (U.S. Department of Agriculture, Natural Resources Conservation Service 2004).

Habitat: Wedge sandmat is known only from pine rockland vegetation on Big Pine Key, Monroe County, Florida (Small 1933, Long and Lakela 1971, Wunderlin 1998, Ross and Ruiz 1996). "Pine rocklands in the Lower Florida Keys are dominated by a canopy of southern slash pine *P. elliottii* var. *densa*. The subcanopy is composed of several palms such as Key thatch palm (*Thrinax morrisii*), Florida thatch palm (*Thrinax radiata*), and silver palm (*Coccothrinax argentata*), and several hardwoods such as locustberry (*Byrsonima lucida*), longstalked stopper (*Psidium longipes* [*Mosiera longipes*]), and poisonwood (*Metopium toxiferum*)." (Bradley and Gann 1999). There is also a rich herbaceous layer composed of grasses and herbs. Outcropped limestone bedrock and exposed calcareous rubble are prominent features associated with pine rockland communities (Snyder et al. 1990, Ross and Ruiz 1996, U.S. Fish and Wildlife Service 1999). In addition to the more common associates, *C. deltoidea* ssp. *serpyllum* "…can grow in association with other rare taxa, including sand flax (*Linum arenicola*), and Big Pine partridge pea (*Chamaecrista lineata* var. *keyensis*)" (Bradley and Gann 1999). *C. deltoidea* ssp. *serpyllum* was further associated, through discriminant analysis, with extensive exposed rock substrate, low total understory cover and low hardwood density (Ross and Ruiz 1996). "Plants grow directly from crevices in the oolitic rock substrate" (Bradley and Gann 1999). It is shade intolerant and requires periodic burning to reduce competition from woody vegetation.

Ross and Ruiz (1996) stated that periodic fire is necessary for the perpetuation of *C. deltoidea* ssp. *serpyllum* and other pine rockland flora of the lower Keys. The pine rocklands of the lower Keys have evolved and adapted to relatively frequent fires. In the absence of fire these areas mature into hardwood hammock (Snyder et al. 1990). Alexander and Dickson (1972) estimated that the conversion to hardwood hammock may take about 50 years in the Keys. A fundamental question about fire ecology in pine rocklands is how frequently they should burn and during what season. Snyder et al. (1990) estimated fire regimes on the Florida mainland. The minimum period they found was two to three years and the maximum was 15 years. This wide range in fire frequencies would result in different forest structures and dynamics. This lead Bradley and Gann (1999) to suggest that a mosaic of burns should be used in the management of pine rocklands.

Presently, the recommended burn regime in Miami-Dade County pine rocklands is three to seven years with summer fires generally preferred to winter. It is likely that this is too short a fire frequency in the Florida Keys where soil and water conditions limit plant growth. Summer fires are preferred since most lightning strikes (the historical cause of fires) occur in the summer

months. In areas where fires have been suppressed for many years, the reintroduction of fire may have to be done in a step-wise fashion. In some areas it may include winter burns, or removal of some fuel to prevent a hot fire. Any prescribed fire management should include a monitoring program to determine the effectiveness of the prescription. There should also be a component to the monitoring that captures the health of the community and species that occur in association with *C. deltoidea* ssp. *serpyllum* and its associates (Bradley and Gann 1999). Conservation planning at National Key Deer Refuge has sought to apply optimal timing of fires.

National Key Deer Refuge is able to conduct prescribed fires in much of the pinelands under its jurisdiction. The Refuge uses mechanical treatments sparingly, largely to control hardwoods for fire breaks, around houses adjoining Refuge property, and to reduce fuels on land that is purchased by the State for management by the Refuge. In some cases, the Refuge does allow former pineland to develop into tropical hardwood hammock. Exotic pest plant control is largely by herbicide spraying, using backpack sprayers (Phil Frank, National Key Deer Refuge, pers. comm. 2005).

The Nature Conservancy conducted about two acres of mechanical thinning of hardwoods in pineland at its Terrestris Preserve, using inflatable-tired equipment to minimize damage to the ground surface, in the early dry season (October). The following wet season (August), the area was burned. The treatment reduced pine mortality and jump-started recovery of the vegetation. Monitoring had shown very little of *Chamaesyce deltoidea* ssp. *serpyllum* and other herbs before treatment. These herbs started to appear after mechanical treatment then appeared in abundance after the fire (Chris Bergh, The Nature Conservancy, pers. comm. 2005). The Service's Coastal Program has supported The Nature Conservancy program in the Keys (Project Greensweep) to remove exotics from private property.

Historical Range/Distribution: Wedge sandmat is known only from Big Pine Key, Monroe County, Florida (Bradley and Gann 1999, Small 1933, Long and Lakela 1971, Wunderlin 1998, Ross and Ruiz 1996). The current and historic ranges are similar.

Current Range/Distribution: Wedge sandmat is known only from Big Pine Key and most plants occur on National Key Deer Refuge. The species is present on the 20-acre Terrestris Preserve owned by The Nature Conservancy (Gann et al. 2002). Additional plants occur on unprotected, privately-owned lands within the vicinity of the Refuge. Within Big Pine Key, it is not evenly or very widely distributed. Ross and Ruiz (1996) found it in 32 of 145 (22 percent) of their circular sample plots in pine rockland. They estimated the pine rockland area of Big Pine Key to be 665.5 hectares (ha) (1,645 acres). The sampling intensity of their plots represented 0.17 percent of those pine rocklands. The 145 plots were distributed along 13 linear transects. Plots with *C. deltoidea* ssp. *serpyllum* occurred in 8 of these. It was not found along transects in the western or southern portions of Big Pine Key. However, densities exceeded 2 plants per square meter in two transects. Similarly, Herndon (1993, *in* Bradley and Gann 1999) found the distribution of *C.*

deltoidea ssp. *serpyllum* colonies to be somewhat scattered, and that the total population size was not large.

Hodges and Bradley (2005) initiated a study of distribution and abundance, including systematic sampling for wedge sandmat throughout publicly owned pine rockland across Big Pine Key. The survey area includes Monroe County and State owned parcels. This will provide the first comprehensive survey of distribution and abundance for the area.

Population Estimates/Status: On a $\log_{10}$ scale, the total population size is probably on the order of 1,001 to 10,000 plants (Bradley and Gann 1999). On The Nature Conservancy's Preserve, monitoring was conducted annually from 1993 through 2002 (Slapcinsky and Gordon 2003). Mean frequency of wedge spurge occurrence among plots changed from 9.7 to 7.4 in unit 1 (1993-2002), 3.7 to 8.0 in unit 2 (1994-2002) and 17.3 to 3.4 in unit 3 (1993-2002). Approximately 1,000 or fewer plants occurring on unprotected, privately-owned lands (Ross and Ruiz 1996; Keith Bradley and George Gann, The Institute for Regional Conservation, pers. comm. 1999). According to Bradley and Gann (1999), *C. deltoidea* ssp. *serpyllum* is probably declining. Given the species narrow habitat range and small population size, *Chamaesyce deltoidea* ssp. *serpyllum* is vulnerable to extinction.

THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range.

Acreage of pine rocklands on Big Pine Key was reduced from 1,049 ha (2,592 acres) in 1955 to 701 ha (1,732 acres) in 1989 (Folk 1991). This constitutes a habitat loss of approximately 33 percent. Subsequently, Ross and Ruiz (1996) estimated the pine rockland area of Big Pine Key to be 665.5 hectares (ha) (1,645 acres). An unknown portion of the pine rockland habitat outside of National Key Deer Refuge is still threatened by development. Based on long-term and recent trends, the development pressures in the Florida Keys, including the range of *C. deltoidea* ssp. *Serpyllum*, are not expected to diminish in the years to come.

Florida had experienced a 15.3 percent increase in the human population from April 1, 1990, to July 1, 1998, and was ranked as the fourth fastest growing state in the nation during 1998 (U.S. Census Bureau 1998). Monroe County, which consists of the Keys and mostly-uninhabited mainland, is expected to experience moderate population growth. The county's past and projected population is: 1990, 78,024; 2000, 79,589; 2010, 82,769; and 2020, 84,765 (Florida Legislature 2004). Average annual population growth for Monroe County, 2000-2004 is 0.62 percent per year and the trend is 1 percent per year or less (Florida Trend 2004).

Land acquisition for National Key Deer Refuge and through the Florida Forever Program continues, although some of the remaining pine rockland habitat in the lower Keys remains subject to development. A Habitat Conservation Plan for the endangered Key

deer on Big Pine and No Name Keys is under development. When finalized, it may benefit the endemic plants of Big Pine Key, including *C. deltoidea* ssp. *serpyllum*. Private, undeveloped pine rocklands on Big Pine Key are generally not managed in a manner that would benefit *C. deltoidea* ssp. *serpyllum*. Accordingly, only those parcels that are acquired for conservation purposes are effectively managed for *C. deltoidea* ssp. *serpyllum*, can benefit the long-term persistence of the taxon.

B. Overutilization for commercial, recreational, scientific, or educational purposes. None known.

C. Disease or predation. None known.

D. The inadequacy of existing regulatory mechanisms. The Florida Department of Agriculture and Consumer Services designated *C. deltoidea*, which includes ssp. *serpyllum* as endangered under Chapter 5B-40, Florida Administrative Code. This listing provides little or no habitat protection beyond the State's Development of Regional Impact process, which serves to disclose impacts from projects, but provides no regulatory protection for State-listed plants on private lands.

E. Other natural or manmade factors affecting its continued existence. Lack of fire, invasive exotic plant incursions, and sea level rise are threats to *C. deltoidea* ssp. *serpyllum* habitat. For the most part, the magnitude and imminence of these threats largely differ among sites in conservation status verses lands in the private sector. Catastrophic events in the form of hurricanes pose an additional threat.

The absence of fire constitutes a detrimental habitat disturbance for *C. deltoidea* ssp. *serpyllum* and other rock pineland endemics and their associates, and threatens their probability of persistence. Pine rockland flora is maintained by relatively frequent fires, which limits the volume and height of understory components. In the absence of fire, many areas become wooded, forming tropical rockland hammock. Wunderlin and Hansen (2000) comment that rockland hammock plants are rooted in a thin layer of organic soil overlying the rock, or pocketed in solution holes. This organic material burns readily when dry, so that by limiting accumulations of organic matter, fires have limited the extent of hammocks. "Periodic fires eliminate the shrub subcanopy and remove litter from the ground" (Bradley and Gann 1999). As with other pine rockland endemics, *C. deltoidea* ssp. *serpyllum* is shade intolerant, and requires periodic burning to preclude shading from woody vegetation (Ross and Ruiz 1996, The Nature Conservancy 1999).

Fire suppression is the most widespread threat to *C. deltoidea* ssp. *serpyllum*. Fire is required to maintain the pine rockland community. Under natural conditions, lightning fires typically occurred at intervals of at least three to seven years. With fire suppression, hardwoods eventually invade pine rocklands and shade out understory species like *C.*

deltoidea ssp. *serpyllum*. Fire suppression has reduced the size of the areas that do burn and habitat fragmentation has prevented fire from moving across the landscape in a natural way. As a result, pine rockland communities tend toward tropical hardwood hammock communities. In many areas, pine rockland communities have moved past their normal fire subclimax and are succeeding to tropical hardwood hammock communities. The Nature Conservancy's Terrestris Preserve on Big Pine Key has for 10 years been conducting relatively frequent, growing-season prescribed fire, experimental mechanical pre-fire fuel treatments, and ongoing monitoring to quantify the effects of these efforts on community structure and rare plants (U.S. Geological Survey 2004). An experimental mechanical treatment followed by wet-season fire brought a quick resurgence of pineland herbs, including this one (Chris Bergh, pers. comm. 2005).

Experimental fire regimes are being conducted on National Key Deer Refuge. In 2003, the Refuge burned a 120-acre site that had been unburned for 17 years. The fire management activities are designed to induce two burns per year for 2 years, at 8 ha (20 ac) a year. This management plan is designed to benefit the Key deer and the threatened Garber's spurge (*C. garberi*) in pine rockland areas, and in patches that are succeeding to hardwood overstories. *C. deltoidea* ssp. *serpyllum* is expected to benefit. The Service is working cooperatively with Florida International University in Miami to determine the proper fire frequencies necessary to maintain the pine rockland community on the Refuge, results are not yet available. Additionally, habitat degradation due to lack of fire in the pinelands is being addressed through the Lower Keys Wildland Fire Hazard Reduction Initiative. In addition to National Key Deer Refuge, this informal consortium includes The Nature Conservancy and state agencies, all of which address prescribed fire planning and execution cooperatively.

At least 277 taxa of exotic plants are now known to invade pine rocklands in south Florida (U.S. Fish and Wildlife Service 1998). Some of these may compete directly with *C. deltoidea* ssp. *serpyllum* for space and resources, while others have a profound effect on community structure and responses to fire. Brazilian pepper (*Schinus terebinthifolius*) is the most widespread and one of the most invasive species. If left uncontrolled in a fire-suppressed pineland, it will form a dense monospecific canopy almost completely eliminating native vegetation. Earleaf acacia (*Acacia auriculiformis*), natal grass (*Rhynchelytrum repens*), shrub verbena (*Lantana camara*), and woman's tongue tree (*Albizia lebbeck*) are some of the other exotic pests in pine rocklands. All of these species affect the characteristics of a fire when it does occur. Fires that once burned fairly coolly with mostly pine needle duff for fuel may now burn much hotter and affect the vegetation that develops following fire. For instance, a catastrophic fire may cause grasses to die out and be replaced by bracken fern thickets. Therefore, in the presence of exotic species, it is uncertain just how a managed fire regime will affect *C. deltoidea* ssp. *serpyllum*. Because of these factors, invasive exotic plants could pose the greatest threat to *C. deltoidea* ssp. *serpyllum*. However, this is not the case in practice. Through efforts of National Key Deer Refuge and the Florida Keys Invasive Exotics Task Force

(including The Nature Conservancy, state agencies, and National Key Deer Refuge), exotics control and removal on Big Pine Key has advanced beyond fire management. At the National Key Deer Refuge, most exotics control is done by backpack spraying with herbicides (Phil Frank, National Key Deer Refuge, pers. comm. 2005). Prescribed fires further help suppress or kill exotics.

An experiment by The Nature Conservancy restored pinelands by carefully using inflatable-tired mechanical equipment to remove encroaching hardwoods, followed by prescribed fire. Mechanical treatments using such equipment is probably mainly of importance for maintaining fire breaks, reducing fuel loads and fire hazards near houses, and for restoring small, neglected parcels of land that are continuing to be purchased by the State for management by National Key Deer Refuge. The Refuge does not anticipate extensive use of mechanical methods to control invasive pest plants. Based on this information, mechanical treatments of exotic pest plants on conservation lands appear to benefit, not threaten, this species.

Pine rockland vegetation in the Keys has undergone a reduction in area due to sea-level rise, according to Ross et al. (1994). For example, pine rockland on Sugarloaf Key covered 88 ha some time prior to 1935, and was reduced to 46 ha by 1935 and 30 ha by 1991. The loss of pine rockland communities was correlated with elevated ground- and soil water salinity, and loss of upland plant diversity was inferred. More halophytic plants assembled within the areas previously occupied by the pine rockland community.

Catastrophic events in the form of hurricanes and tropical storms are an additional threat. Hurricanes can permanently change the physiognomy of the landscape and inundate otherwise unaltered landscapes with saltwater for varying durations. Hurricanes may also result in direct damage to plants and plant communities through tearing, crushing and abrasion effects. The small area, small population size, and somewhat patchy distribution of *C. deltoidea* ssp. *serpyllum* renders it susceptible to extinction through such stochastic events. Further reduction of population size would likely enhance threats associated with genetics and demographic stochasticity (Templeton et al. 1990, Fischer and Matthies 1998).

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

A Habitat Conservation Plan for the Key deer, currently in preparation, may benefit *C. deltoidea* ssp. *serpyllum*.

SUMMARY OF THREATS

This species has lost approximately 33 percent of its pine rockland habitat and habitat outside of National Key Deer Refuge is still threatened by development. Based on long-term and recent trends, the development pressures in the Florida Keys are not expected to diminish in the years to come. Lack of fire, invasive exotic plants, and sea level rise are threats to *C. deltoidea* ssp.

serpyllum and its habitat. For the most part, the magnitude and imminence of these threats largely differ among sites in conservation status verses lands in the private sector. Catastrophic events in the form of hurricanes pose an additional threat.

For species that are being removed from candidate status:
___Is the removal based in whole or in part on one or more individual conservation efforts that you determined met the standards in the Policy for Evaluation of Conservation Efforts When Making Listing Decisions (PECE)?

RECOMMENDED CONSERVATION MEASURES

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent	Monotypic genus	1
		Species	2
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	**6***
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude: We do not have new monitoring information, although a population survey is currently under way. We are maintaining the previous assessment that a very narrow distribution composed of small semi-isolated sub-populations, combined with threats from lack of fire, invasive exotic plants, and hurricanes, make for an overall high magnitude of threat. *C. deltoidea* ssp. *serpyllum* exists essentially as a single population on Big Pine Key, which over the long run has protective measures only on the Refuge and the Terrestris Preserve. For most of the population, the level of threat from fire exclusion depends upon the fire management regime applied on the Refuge and the Terrestris Preserve. Due to reporting and publication pending in late 2005, we expect to obtain additional information on how fire management in National Key Deer Refuge effects the distribution and conservation of *C. deltoidea* ssp. *serpyllum*. There is a

strong likelihood that *C. deltoidea* ssp. *serpyllum* can persist in areas that are managed with fire. Affected populations can be salvaged with the return or advent of fire management, unless confounded by invasive plants, which is unlikely due to active exotics control on the Refuge. Recent prescribed burns on long-unburned areas of the Refuge offer an opportunity to observe whether this species benefits, and whether effects from the lack of fire can be reversed. For the other 10 percent of the area occupied by this species, some level of threat from human development and related factors remains. Some small (unknown) proportion of that private sector component may still be acquired through the Florida Forever program, and some small (unknown) proportion of that may hold *C. deltoidea* ssp. *serpyllum* and be conducive to management to benefit its persistence. The magnitude of threats from hurricanes and tropical storms is difficult to determine.

Imminence: About 90 percent of the plants are on National Key Deer Refuge. Therefore, over most of the species range, threats in the form of human development and other causes are controlled to a significant degree. Since the majority of the range occurs within National Key Deer Refuge, questions of imminence of threats are primarily questions of the adequacy and effectiveness of prescribed fire in the pinelands. The existing literature indicates that fire return intervals are relatively long in the lower Keys. Due to low precipitation, the vegetation does not grown as rapidly as it does on the mainland. This provides Refuge managers with greater leeway than would be the case in some mainland pinelands. Fire management is being accomplished and invasive exotic pest plants have not overrun the Refuge. The best available information indicates that while this plant is intrinsically vulnerable to extinction because it is a narrow endemic, existing Refuge management is unlikely to need to be altered abruptly or radically to maintain the species. There has been a 15 centimeter rise in sea level over a 70 year period in the vicinity of Big Pine Key (Ross et al. 1994). For Big Pine Key, quantitative data on the resulting loss of pine rockland community due to sea-level rise is not available.

Rationale for Change in Listing Priority Number (insert if appropriate): N/A

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. Within National Key Deer Refuge and Big Pine Key in general, the rate of burning in recent years and that planned for the next several years meets or exceeds the rate of burning during the preceding 10 years. Similarly, control of invasive exotic plants has progressed in recent years to the extent that weed expansion has been controlled, natural areas are being maintained and affected habitats are being restored within National Key Deer Refuge and other conservation lands on Big Pine Key. Accordingly, we have no evidence to indicate that remaining populations of the spurge have been further imperiled since the previous review.

DESCRIPTION OF MONITORING: The Service has conducted extensive literature searches and obtained all recent and most historical documents pertaining to wedge spurge. At this time,

wedge spurge is known only from Big Pine Key and most plants occur on National Key Deer Refuge. Within Big Pine Key, this species does not appear to be evenly or very widely distributed.

Although the Refuge has an active prescribed fire program that should benefit the wedge spurge, the species is not regularly monitored on National Key Deer Refuge. Accordingly, the current status of the spurge is unknown for the Refuge. To fill this gap, the Service funded a project (Hodges and Bradley 2005) to comprehensively assess wedge spurge abundance on the Refuge and other conservation lands in pine rockland throughout Big Pine Key. Once completed, findings will be compared to those of Ross and Ruiz (1996) so that the quantitative changes in abundance and qualitative changes in distribution can be assessed.

The wedge spurge also occurs on The Nature Conservancy's Terrestris Preserve on Big Pine Key. The TNC conducts burns every several years on 3 units across this preserve, and also applied mechanical thinning to one of the units. Monitoring was conducted annually from 1993 through 2002 (Slapcinsky and Gordon 2003). Mean frequency of wedge spurge occurrence among plots changed from 9.7 to 7.4 in unit 1 (1993-2002), 3.7 to 8.0 in unit 2 (1994-2002) and 17.3 to 3.4 in unit 3 (1993-2002). These figures represent a decrease, a no-change, and an increase in response to the selected burning regimes. However, a lack of management using fire would be expected to reduce wedge spurge persistence on all sites, given enough time. TNC will report the results of the most recent samples (2004) once they are compiled.

The Refuge has an active prescribed fire program which should benefit the wedge spurge. The Service is also collaborating with The Nature Conservancy to assemble, reconstruct, and render on GIS all known wildland fire histories for the Lower Keys, including the prescribed fires on and adjacent to the Refuge in recent years. The Service will attempt to ensure that the fire history distribution is appropriately incorporated into the sampling scheme of future inventories and monitoring efforts, so that inferences may be drawn as to the effects of varied fire regimes.

The Service believes that the status of wedge spurge has either remained the same or further benefited from land acquisition, exotic pest plant control, and prescribed burning efforts on the National Key Deer Refuge and lands managed by The Nature Conservancy.

COORDINATION WITH STATES

Indicate which State(s) (within the range of the species) provided information or comments on the species or latest species assessment: none

Indicate which State(s) did not provide any information or comments: Florida

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Wunderlin, R. P. and B. F. Hansen. 2000. Flora of Florida, vol. 1: Pteridophytes and gymnosperms. University Press of Florida, Gainesville. 366 pp.

APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve: /s/ Jeffrey M. Fleming 11/16/2005
Acting Regional Director, Fish and Wildlife Service Date

Concur: _____ August 23, 2006
Acting Director, Fish and Wildlife Service Date

Do Not Concur: _____ _____
Director, Fish and Wildlife Service Date

Date of annual review: October 2005

Conducted by: South Florida (Vero Beach) Field Office